

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 4 0408	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/FI 2003/000808	International filing date (day/month/year) 31.10.2003	Priority date (day/month/year) 01.11.2002
International Patent Classification (IPC) or national classification and IPC B22F 3/15, B22F 3/17, B22F 7/00, C22C 29/00, C22C 32/00		
Applicant Metso Powdermet OY et al		

1.	This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2.	This REPORT consists of a total of <u>6</u> sheets, including this cover sheet.
3.	This report is also accompanied by ANNEXES, comprising: <div style="margin-left: 20px;"> a. <input checked="" type="checkbox"/> (sent to the applicant and to the International Bureau) a total of <u>2</u> sheets, as follows: <div style="margin-left: 20px;"> <input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. </div> </div> <div style="margin-left: 20px;"> b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions). </div>

4.	This report contains indications relating to the following items: <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> Box No. I Basis of the report <input type="checkbox"/> Box No. II Priority <input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input type="checkbox"/> Box No. IV Lack of unity of invention <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement <input checked="" type="checkbox"/> Box No. VI Certain documents cited <input type="checkbox"/> Box No. VII Certain defects in the international application <input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application </div>
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Date of submission of the demand 07.05.2004	Date of completion of this report 10.02.2005
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88 Form PCT/IPEA/409 (cover sheet) (January 2004)	Authorized officer Nils Engnell/ELY Telephone No. +46 8 782 25 00

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI 2003/000808

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☐ the international application as originally filed/furnished

- ☒ the description:

pages 1 - 6 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

- ☒ the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 8 - 9 received by this Authority on 29.09.2004

pages* _____ received by this Authority on _____

- ☐ the drawings:

pages _____ as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-5</u>	YES
	Claims	<u>6-7</u>	NO
Inventive step (IS)	Claims	<u>1-5</u>	YES
	Claims	<u>6-7</u>	NO
Industrial applicability (IA)	Claims	<u>1-7</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Reference is made to the following documents:

D1: US 6 451 442 B1
D2: US 4 869 974 A
D3: US 4 925 457 A
D4: US 4 032 335 A

Discussion.

The invention according to claim 1 refers to a method for manufacturing multi-material parts. The materials are a hard wear-resistant material and a tough material. The materials are placed in a desired distribution and are densified by hot isostatic pressing. The method is characterized in that the compacted body is hot worked.

This combination of measures is not disclosed in the cited documents and is considered to involve an inventive step.

Multi-material parts according to claims 6 and 7 are previously known. One major reason is that claims 1-7 are in fact ambiguous (see Box VIII). D1 (col. 2, ll. 16-54, col. 4, l. 47-col. 5, l. 43, col. 6, l. 59-col. 8, l. 31 and fig. 2-11) discloses composites comprising a hard component and a tough component in an ordered structure, for example honeycomb. D2 (col. 2, ll. 36-47, col. 3, ll. 8-32, col. 3, l. 63-col. 4, l. 16, fig. 1-6c and claims 1-5) discloses plates consisting of alternate lamellas of hard and tough materials. D3 discloses a flexible carrier with embedded hard particles.

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: Box V

D4 discloses a body comprising hard bodies embedded in a hot isostatically pressed powder sheath. The statement that the part according to claim 6 is produced by the method according to claim 1 does not add any further information about the material or the part.

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Box No. VI Certain documents cited

1. Certain published documents (Rule 70.10)

Application No.
Patent No.
_____Publication date
(day/month/year)
_____Filing date
(day/month/year)
_____Priority date (valid claim)
(day/month/year)

WO 03/057938 A1 17/07/2003 09/01/2003 10/01/2002

The document discloses a method of producing a tool component comprising hard material fibres embedded as bundles in a binder metal. The method comprises several extrusion steps. The tool component may have the features stated in present claims 6 and 7.

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure
_____Date of non-written disclosure
(day/month/year)
_____Date of written disclosure
referring to non-written disclosure
(day/month/year)

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

In claims 1-7 there is no information about the materials, except that there is over 50% iron in the tough material, the sizes and configurations of the material component pieces and the relative amounts of the materials. The hot working degree is only related to the cross-sectional areas, other important parameters are not referred to. Consequently, the scope of the claims is very extensive.

What is claimed is:

1. A method for manufacturing multimaterial parts, the multimaterial used in the method containing a tough ferrous ($\text{Fe} > 50 \text{ wt. \%}$) material component (B) in a desired distribution with a hard, wear-resistant material (A), in which method a green body is prepared from the tough material component (B) and the hard material component (A) by isostatic hot pressing into a substantially densified green body, **characterized** in that the green body is hot worked up to a hot working degree 2 minimum so as to obtain a desired distribution between the tough material component (B) and the hard material component (A), and the working degree is determined from the cross-sectional areas of the body prior to and after hotworking.
2. The method of claim 1, **characterized** in that the wear-resistant component (A) and the tough component (B) may be in either powderized, partially densified or entirely solid state prior to starting the densification of the green body.
3. The method of claim 1 or 2, **characterized** in that the wear-resistant component (A) is a ferrous material ($\text{Fe} > 50 \text{ wt. \%}$) or, alternatively, a mixture of a ferrous material and a ceramic material (carbide, oxide, nitride, boride, etc.) containing not more than 30 wt. % of a metallic binder, whereby the hardness of the material is greater than HRC 35, advantageously greater than HRC 50.
4. The method of any one of claims 1-3, **characterized** in that the tough material component (B) is a ferrous ($\text{Fe} > 50 \text{ wt. \%}$) or nickel ($\text{Ni} > 50 \text{ wt. \%}$) based material, whereby the hardness of the material is not greater than HRC 35, advantageously not greater than HRC 25.
5. The method of any one of claims 1-4, **characterized** in that the wear-resistant material component (A) is prepared from a powderized raw material in which the chemical composition of the ferrous metallic powder ($\text{Fe} > 50 \text{ wt. \%}$) in the powderized mixture is 0.5-3.5 wt. % carbon, 0.5-15 wt. % chromium, 0-5 wt. % molybdenum, less than 2 wt. % manganese and less than 2 wt. % silicon, and the propor-

tion of the carbide-forming additives such as V, Nb, Ti and W compounds in total is 3-20 wt.% and, additionally, the powderized mixture contains not more than 50 wt. % ceramic particulates in which the proportion of a metallic binder is not greater than 30 wt. %, the rest of the composition comprising impurities or trace amounts of different additives.

6. A multimaterial part manufactured according to any of the claims 1-5 whose composition includes at least a tough ferrous ($\text{Fe} > 50 \text{ wt. \%}$) material component (B) combined with a hard, wear-resistant material (A), **characterized** in that

- the tough material component (B) forms in a workable green body an essentially homogeneous longitudinal structure, whose proportion in the green body cross section is 10-50 vol. %,
- the cross-sectional area of a single fiber of the tough material (B) is greater than 1 mm^2 average and the minimum dimension in the cross section of a single fiber or in the wall a honeycomb-like tough structure is greater than 0.5 mm, and
- the hardness of the hard material component (A) after heat treatment is not less than HRC 40.

7. The multimaterial part of claim 6, **characterized** in that the volume proportion of the tough material component (B) in the finished multimaterial part is 20-40 vol. %.